SOIL SAMPLING AND ANALYSIS PLAN

14356-14400 PEARL ROAD
STRONGSVILLE, CUYAHOGA COUNTY, OHIO

NOVEMBER 2010
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Prepared for:

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H10013-11

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1.0 Introduction

The Cuyahoga County Commissioners Department of Development (the County) retained HzW Environmental Consultants, LLC (HzW) as a consultant to conduct a Phase II Environmental Site Assessment (ESA) of 14356-14400 Pearl Road located in Strongsville, Cuyahoga County, Ohio (the Property). The regional location of the Property is presented as **Figure 1**.

The Property is located at the northwest corner of Pearl Road and Pierce Drive in Strongsville. The Property is developed with one (1) multi-tenant commercial building that fronts Pearl Road and one (1) commercial building behind the multi-tenant building along Pierce Drive. The remainder of the Property consists of asphalt parking lots in the eastern and western portions. Land use surrounding the Property consists of a contiguous multi-tenant commercial building to the north, the right-of-way of Pearl Road to the east with commercial properties further east, the right-of-way of Pierce Drive to the south with commercial properties further south, and residential properties to the west. **Figure 2** presents the current site conditions at the Property.

2.0 Background

During July through December 2008, Atwell-Hicks Development Consultants (Atwell-Hicks) conducted a Phase I ESA, Phase II Subsurface Investigation and an Additional Phase II Subsurface Investigation of the Property. These investigations identified the former use of several tenant spaces on the Property as dry cleaning facilities. Subsequent soil and groundwater sampling activities identified impacts to soil and groundwater at the Property. Further discussion of the Atwell-Hicks investigations provided to HzW for review is presented in Section 4.0. This Soil Sampling and Analysis Plan (SAP) is being prepared in order to further delineate impacts to soil at the Property prior to redevelopment.

HzW will provide the skill and expertise to complete the Phase II ESA of the Property, and prepare a report of the findings of this investigation. The report will include a discussion regarding additional assessment and/or remedial actions for the Property. This Soil SAP presents the methods that will be used during soil sample collection. This SAP has been prepared for use by HzW personnel only. Compliance with this SAP and the previously approved Quality Assurance Project Plan dated February 2010 will ensure that representative soil samples are obtained from all boring locations.

3.0 Physical Setting

The United States Geological Survey 7.5-minute series, Berea, Ohio, quadrangle topographic map indicates that topography within the vicinity of the Property slopes to the northwest and west towards a series of intermittent and perennial streams, one of which is identified as Baker Creek. The topographic map indicates that the Property is nearly level with an approximate elevation of 930 feet above National Geodetic Vertical Datum (NGVD). According to the *Surifical Geology of the Cleveland South 30 x 60 Minute Quadrangle Map* published by the Ohio Department of Natural Resources (ODNR), the Property is underlain by Wisconsin-age till. The Wisconsin-age till consists of an unsorted mix of clay, silt, sand, gravel and boulders that may be up to an average of 20 feet thick, which overlies Mississippian-age sandstone and shale of the Cuyahoga Formation, Berea Sandstone and Bedford Shale groups.

The *Ground Water Resources Map of Cuyahoga County* and *Geologic Map of Ohio*, both published by the ODNR, corroborate the subsurface geology. According to the *Ground Water Resources Map of Cuyahoga County* groundwater underlying the Property is obtained from the Cuyahoga Group or Chagrin, Ohio and Bedford Shales. Aquifers that yield three (3) to ten (10) gallons of groundwater per minute may be encountered less than 30 feet below land surface. The *Geologic Map of Ohio* indicates that the bedrock underlying the Property consists of Mississippian-age sandstone, siltstone and shale of the Cuyahoga Formation. Bedrock topography, according to *Bedrock Topography Map* of the Berea, Ohio, quadrangle published by the ODNR, is located approximately 915 feet above NGVD within the vicinity of the Property and slopes to the north.

4.0 Previous Data Collection

As mentioned in Section 2.0, several previous investigations have been conducted at the Property by Atwell-Hicks. Copies of a Phase I ESA dated September 4, 2008, prepared by Atwell-Hicks, and an Additional Phase II Subsurface Investigation dated December 4, 2008 prepared by Atwell-Hicks were provided to HzW for review. A summary of each investigation is presented below.

4.1 Phase I Environmental Site Assessment Report for the New Prototype Banking Center, 14356-14400 Pearl Road, Strongsville, Ohio, Prepared by Atwell-Hicks, September 4, 2008

Atwell-Hicks conducted a Phase I ESA of the Property in accordance with the American Society of Testing and Materials (ASTM) Designation E 1527-05 and 40 CFR Part 312 (All Appropriate Inquiry). At the time of the Atwell-Hicks Phase I ESA, the Property was occupied by several commercial tenants including Shrimp and Lobster (14356 Pearl Road), Super Hair Unisex Hair Design (14358 Pearl Road), Minka’s Tailoring (14362 Pearl Road), Subway (14364 Pearl Road), Page One Realty (14400 Pearl Road, Suite #1), and William Thompson Jr., Attorney at Law (14400 Pearl Road, Suite #3). The tenant spaces located at 14360 Pearl Road, 14368 Pearl Road and 14400 Pearl Road, Suite #2 were vacant.

A review of the EDR report, an environmental database report, by Atwell-Hicks indicated that two (2) tenant spaces on the Property, 14356 and 14360 Pearl Road, and a tenant space on the northern adjacent property were included on the EDR Dry Cleaner database. These tenant spaces were occupied by several dry cleaners (San-i-System Cleaners Co. at 14356 Pearl Road; SS&A Highlander Center Inc. at 14360 Pearl Road; and Walters Coin Operated Dry Cleaning on the northern adjacent property) in 1967.

Based on a review of historic resources, Atwell-Hicks indicated that prior the 1952, the Property was developed as agricultural land. Commercial development – according to Atwell-Hicks – occurred in the early 1950s with a subsequent building constructed in the south-central portion in approximately 1963. Atwell-Hicks stated that dry cleaning facilities occupied the tenant spaces located at 14356 and 14360 Pearl Road in the late 1960s. In addition, the Atwell-Hicks Phase I ESA indicated that geotechnical sampling conducted by G2 Consulting Group, LLC, at the Property identified the presence of foundry sand at depths between one (1) and four (4) feet below ground surface in the west and northwest portions.

Based on the findings, Atwell-Hicks identified the following “recognized environmental conditions” in connection with the Property:

1. Former use of 14356 Pearl Road tenant space as a dry cleaning facility.
2. Former use of 14360 Pearl Road tenant space as a dry cleaning facility.
3. The presence of foundry sand in the western and northwestern portions of the Property as identified in a geotechnical investigation.
4. Former use of a northern adjacent tenant space (14308 Pearl Road) as a dry cleaning facility.
5. The current use of a northern adjacent tenant space (14312 Pearl Road) as a dry cleaning facility.

As a result, Atwell-Hicks recommended conducting a Phase II Subsurface Investigation of the "recognized environmental conditions".

4.2 Additional Phase II Subsurface Investigation for FTCL – Strongsville – 14400 Pearl Road, 14356-14400 Pearl Road, Strongsville, Ohio, Prepared by Atwell-Hicks, December 4, 2008

Subsequent to the Phase I ESA, Atwell-Hicks performed a Limited Phase II Subsurface Investigation in which concentrations of several volatile organic compounds (VOCs) including cis-1,2-dichloroethene (DCE), trans-1,2-DCE, tetrachloroethene (PCE), trichloroethene (TCE) and vinyl chloride were detected in soil samples exceeding the Ohio Environmental Protection Agency's (EPA's) Voluntary Action Program (VAP) Leach Based Soil Values (LBSVs). Based on the findings of the Limited Phase II Subsurface Investigation, Atwell-Hicks conducted additional Phase II activities to determine the extent of subsurface impacts to soil and/or groundwater.

Phase II activities conducted by Atwell-Hicks consisted of installing a total of 25 soil borings, five (5) groundwater monitoring wells and collection of four (4) sub-slab soil gas samples. In addition, six (6) soil borings were converted to temporary well points based on the evidence of groundwater. Six (6) soil borings were installed as part of the Limited Phase II Subsurface Investigation in September 2008, and the remaining 19 soil borings and five (5) monitoring wells were installed in November 2008.

Subsurface materials at the Property – as encountered by Atwell-Hicks – consisted of brown and gray silty clay to a depth of 13 to 14 feet below ground surface overlying gray weathered shale. Following installation of monitoring wells, groundwater was measured at depths between 2.5 and 10 feet below ground surface. Atwell-Hicks concluded that "[t]he groundwater encountered at the site was observed to be relatively inconsistent and perched within sand zones, clay seams and above the underlying shale bedrock." It should be noted that the monitoring well logs included in the Atwell-Hicks report indicate that wells MW-A and MW-D were installed into two (2) feet of shale bedrock, wells MW-B and MW-C into 0.5 feet of shale bedrock, and well MW-E into one (1) foot of shale bedrock. The monitoring wells installed further into shale bedrock produced more groundwater than the monitoring wells not installed as far into shale bedrock.

Soil analytical results indicated that concentrations of several VOCs were detected in soil samples. Concentrations of cis-1,2-DCE, trans-1,2-DCE, PCE, TCE and/or vinyl chloride in several borings exceeded Ohio EPA's VAP LBSVs. In addition, the detected concentration of PCE in one (1) boring at a depth of eight (8) feet below ground surface exceeded Ohio EPA's VAP Generic Direct Contact Soil Standards for commercial/industrial land use and construction/excavation activities. ***The soil samples in which concentrations of VOCs that***

exceeded comparative standards were collected on the exterior portions of the Property. The table below indicates the highest concentrations of VOCs detected in soil that exceeded comparative standards.

Constituent	***Highest Concentration***
cis-1,2-Dichloroethene	***73.0 mg/kg***
trans-1,2-Dichloroethene	***0.29 mg/kg***
Tetrachloroethene	***585 mg/kg***
Trichloroethene	***26.0 mg/kg***
Vinyl chloride	***0.18 mg/kg***

Groundwater analytical results indicated concentrations of several VOCs were detected in groundwater samples. The detected concentrations of 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, PCE, TCE and/or vinyl chloride in groundwater samples from several monitoring wells exceeded Ohio EPA's VAP Generic Unrestricted Potable Use Standards. ***The highest concentrations of VOCs in groundwater samples were detected in monitoring well MW-E in the central portion of the Property. The table below indicates the highest concentrations of VOCs detected in groundwater that exceeded comparative standards.***

Constituent	***Highest Concentration***
1,1-Dichloroethene	***0.017 mg/L***
cis-1,2-Dichloroethene	***3.0 mg/L***
trans-1,2-Dichloroethene	***0.14 mg/L***
Tetrachloroethene	***33.0 mg/L***
Trichloroethene	***2.4 mg/L***
Vinyl chloride	***0.77 mg/L***

Soil gas analytical results indicated that concentrations of one or more VOCs were detected in all four (4) soil gas samples. Atwell-Hicks conducted indoor air modeling by inputting the highest concentration in soil gas samples into the Johnson & Ettinger model. Based on the results of the indoor air modeling, Atwell-Hicks "determined that the VOC excess cancer risk calculated for the subject site is below the Ohio VAP target risk level of 1.0 E^{-5} but above the USEPA target risk level of $1.0E^{-6}$." In addition, Atwell-Hicks indicated that the hazard index for commercial workers at the Property were below the Ohio EPA VAP and USEPA target hazard index.

Atwell-Hicks concluded that potential human health risks exist at the Property based on the concentrations of VOCs detected in soils and groundwater. Further, Atwell-Hicks determined that the highest concentrations of VOCs are "located in the central portion of the property, beneath existing buildings and below or in close proximity to the proposed building footprint" at depths ranging from 4 to 15 feet below ground surface.

5.0 Problem Definition

The Property is located within a viable commercial section in Strongsville, Ohio. Corner 14400 Group, LLC, acquired the Property and intends to redevelop the Property for commercial land use. However, prior to initiating redevelopment activities, Corner 14400 Group, LLC intends to further assess subsurface conditions at the Property. Corner 14400 Group, LLC has received grant funds from the Cuyahoga County Department of Economic Development to further assess the environmental condition of the Property prior to initiation of redevelopment activities.

Soil sampling and analysis will be conducted in order to determine whether the Ohio's Voluntary Action Program (VAP) generic or risk-derived direct-contact standards are exceeded for commercial/industrial land use or future construction/excavation activities or if VAP generic leach-based soil values are exceeded at the Property. A comparison against leach-based soil values will be used to evaluate prospective leaching to groundwater of COCs. The Ohio VAP soil standards and/or values used for data evaluation are included as **Appendix A**.

6.0 Soil Sample Network

6.1 Soil Boring Installation, Sample Methodology and Chemicals of Concern

Soil sampling at the Property will be conducted using manual and/or hydraulic Geoprobe® subsurface sampling methodology. The Geoprobe® is a manual or hydraulic "direct push" sampling device that drives a series of 4- or 5-foot long hollow hardened steel rods into the subsurface. A 2-, 4- or 5-foot long sample tube lined with a clean, disposable acetate (plastic) liner of the same length is driven to a predetermined depth to obtain a relatively "undisturbed" core sample of the subsurface material. Each sample liner will be opened and field screened in two-foot intervals for the presence of organic vapors using a MiniRAE 2000 photoionization detector (PID). The highest field screening result for each two-foot interval will be recorded on the appropriate boring log.

Following completion of field screening activities, the soil sample exhibiting the highest concentration of volatile organic compounds (VOCs) as measured on the PID will be submitted to an independent laboratory for analysis of VOCs by EPA Method 8260, which will be field preserved by EPA Method 5035. All soil samples will be submitted to a VAP Certified Laboratory.

Following completion of sampling activities, all borings installed on the Property will be filled with granular bentonite, hydrated and finished to match the surrounding surface. All equipment used during Phase II ESA sampling activities will be decontaminated with a Liqui-Nox® and distilled water solution and triple-rinsed with distilled water after each use to limit the potential for cross contamination.

6.2 Soil Boring Location/Sample Rationale

Sampling locations were determined based a review of the soil analytical data collected by Atwell-Hicks in 2008, and are intended to further delineate concentrations of VOCs in soil prior to redevelopment activities. In general, soil borings will be installed in the central portion of the Property inclusive of interior and exterior portions of the Property, which is the area of greatest impact identified by Atwell-Hicks. HzW will install approximately 16 additional soil borings at the Property (designated HB-01 through HB-16) to further delineate VOC-impacts to soil. Sampling locations may be modified in the field based on field observations/conditions (e.g., utility locations, accessibility, etc.). **Figure 3** presents the proposed soil sample locations. **Table 1** presents information regarding bore and soil sample identification along with applicable screening method and applicable analysis.

Soil borings will be installed through the concrete floors of the buildings and asphalt of the parking lots at the Property. Sampling of the concrete and asphalt at the Property will not be conducted as part of Phase II ESA activities and will be deferred to the time of remedial activities. During drilling activities, HzW will attempt to minimize dust generation particularly within the buildings when drilling through concrete and asphalt.

HzW will wear appropriate personal protective equipment (PPE) during sampling activities as indicated in the site-specific health and safety plan. The appropriate PPE determination was based on the constituents and concentrations of constituents detected at the Property by Atwell-Hicks in 2008. As indicated in the site-specific health and safety plan, the minimum PPE that will be worn during sampling activities consist of a half-face respirator with organic cartridges (unless real-time air monitoring results indicate otherwise), safety glasses, nitrile gloves, ear plugs and steel toe boots.

6.3 Quality Assurance/Quality Control Sampling

Quality Assurance/Quality Control (QA/QC) duplicate sampling for soils will be conducted as indicated in the Quality Assurance Project Plan (QAPP) using an index of one (1) duplicate soil sample for each twenty (20) "live" soil samples. Field QA/QC will be conducted as indicated in **Table 2**.

7.0 Personnel

Personnel who will perform project management and sampling by this plan will be familiar with this SAP and the QAPP. These individuals and their titles are listed below.

Project Director – Matt Knecht
Project Manager – Doug Wetzel
QA/QC Officer – Barb Knecht
HzW Field Personnel – As assigned

8.0 Project Schedule

An approximate schedule for the Phase II Environmental Site Assessment activities is included in **Table 3**.

9.0 Soil Sample Shipment

All samples will be placed in media provided by a VAP Certified Laboratory. **Table 4** identifies each parameter, container, preservative, and holding time for specific soil samples. All samples will be submitted to the VAP Certified Laboratory in accordance with methods discussed in the QAPP.

FIGURES

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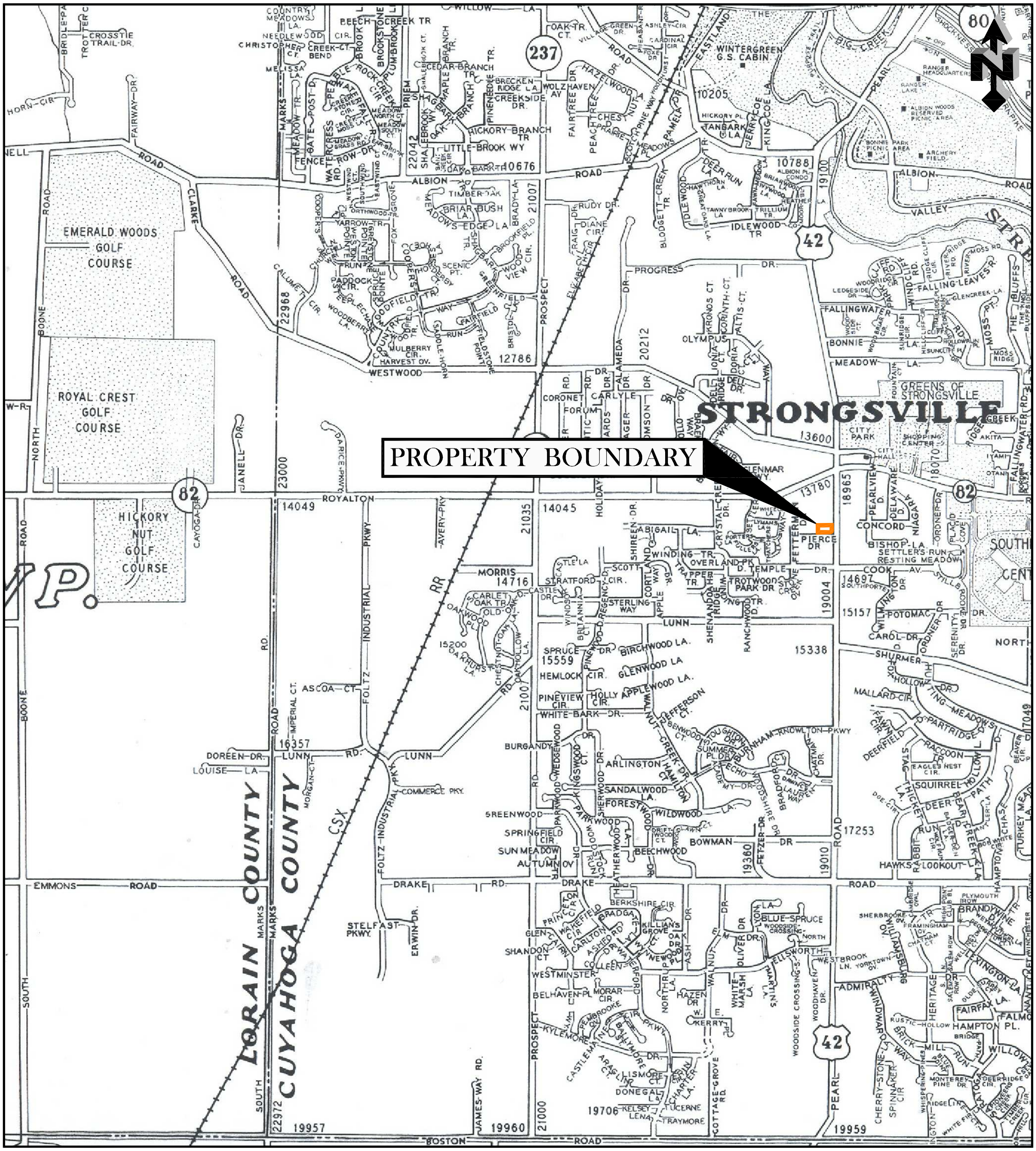

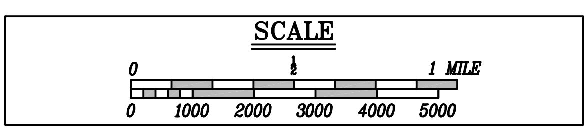

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FIGURE 1
SITE LOCATION MAP
14356-14400 PEARL ROAD,
STRONGSVILLE, CUYAHOGA COUNTY, OHIO

LEGEND

PROPERTY BOUNDARY

BUILDING

NOTE

BASE MAP GENERATED AND TAKEN FROM ATWELL HICKS.

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FIGURE 2
CURRENT SITE FEATURES
14356-14400 PEARL ROAD,
STRONGSVILLE, CUYAHOGA COUNTY, OHIO

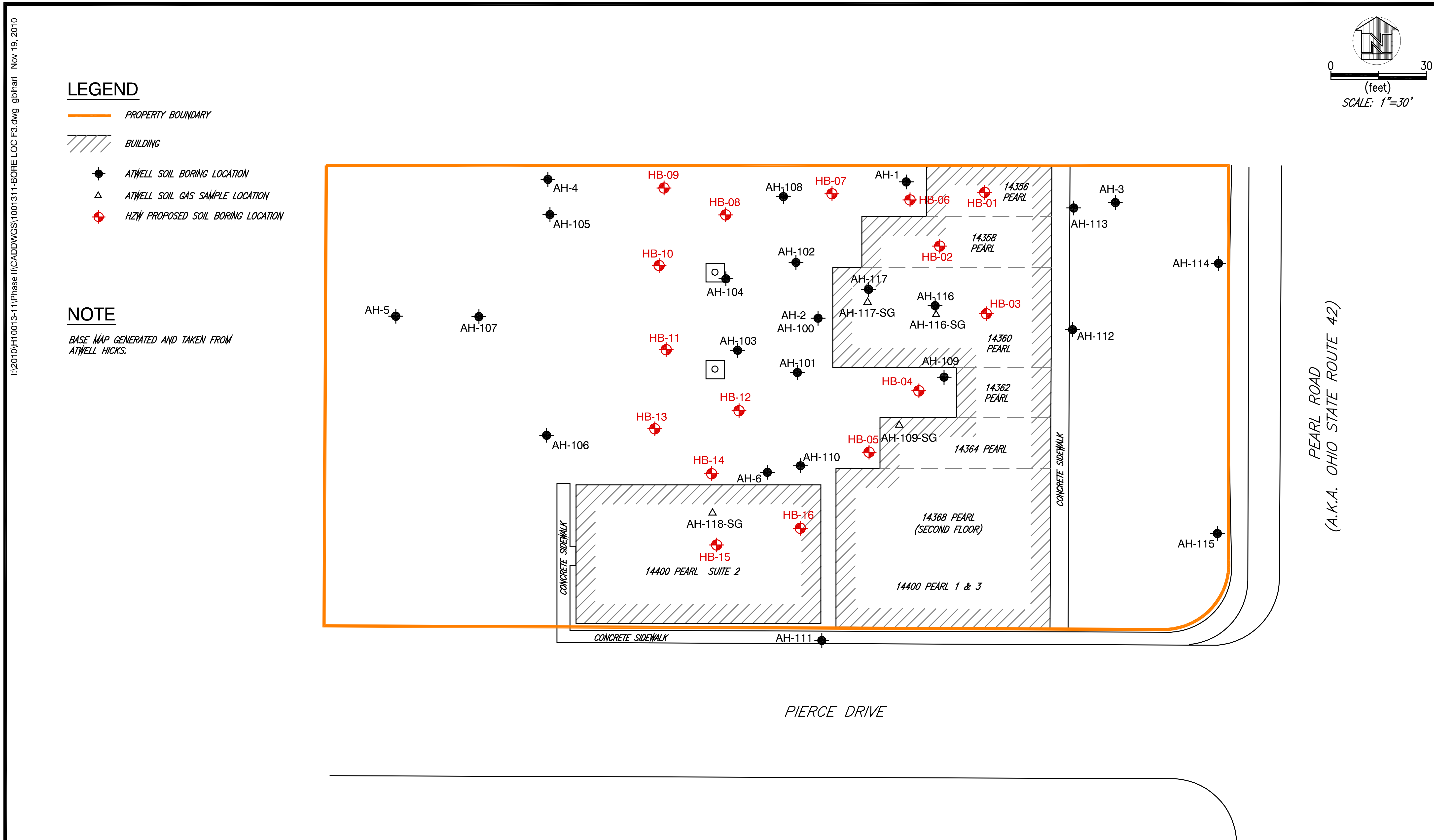

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FIGURE 3
PROPOSED SOIL BORING LOCATION MAP
14356-14400 PEARL ROAD,
STRONGSVILLE, CUYAHOGA COUNTY, OHIO

TABLES

Table 1
Proposed Soil Bore Information
14356-14400 Pearl Road
Strongsville, Ohio

Soil Bore Number	Sample Identification	Sample Interval	Analysis
			VOCs – EPA Method 8260 preserved by EPA Method 5035
HB-01	HB-01-Depth-Date	Highest Field Screening	x
HB-02	HB-02-Depth-Date	Highest Field Screening	x
HB-03	HB-03-Depth-Date	Highest Field Screening	x
HB-04	HB-04-Depth-Date	Highest Field Screening	x
HB-05	HB-05-Depth-Date	Highest Field Screening	x
HB-06	HB-06-Depth-Date	Highest Field Screening	x
HB-07	HB-07-Depth-Date	Highest Field Screening	x
HB-08	HB-08-Depth-Date	Highest Field Screening	x
HB-09	HB-09-Depth-Date	Highest Field Screening	x
HB-10	HB-10-Depth-Date	Highest Field Screening	x
HB-11	HB-11-Depth-Date	Highest Field Screening	x
HB-12	HB-12-Depth-Date	Highest Field Screening	x
HB-13	HB-13-Depth-Date	Highest Field Screening	x
HB-14	HB-14-Depth-Date	Highest Field Screening	x
HB-15	HB-15-Depth-Date	Highest Field Screening	x
HB-16	HB-16-Depth-Date	Highest Field Screening	x

Table 2
Soil QA/QC Sample Summary
14356-14400 Pearl Road
Strongsville, Ohio

QC Sample Type	Frequency of Sample/Analysis	Details
Duplicate Soil Samples	1 per 20 “live” samples submitted to laboratory	The soil sample(s) from the selected duplicate location(s) will be split between two laboratory sample containers; the duplicate will be assigned a unique designation for the purposes of maintaining laboratory non-bias relative to the fact that the duplicate is related to a “live” sample
Decon Blanks	1 per 10 investigative samples submitted to laboratory (per sample matrix)	Distilled water placed into contact with sampling equipment. Used to assess quality of data from field sampling and decontamination procedures.
Trip Blanks	1 per sample cooler/VOC analysis	Laboratory prepared organic-free blank to assess potential contamination during sample container shipment and storage.
Bottle Blanks	1 per 10 investigative samples submitted to laboratory (per sample matrix)	Laboratory-shipped bottles used for sampling. A bottle will be selected at random and sent to the laboratory for analysis.

Table 3
Soil Sampling Schedule
14356-14400 Pearl Road
Strongsville, Ohio

Task	**Date**
Soil SAP Approval	January 2010
Conduct Soil Sampling and Analyses	January 2010
Data Review	January/February 2010

Table 4
Soil Sampling Media
14356-14400 Pearl Road
Strongsville, Ohio

Matrix	Parameter	Container	Preservative	Hold Time
Soil	VOCs	3 – 40 mL glass VOAs; 1 – 4oz glass jar (dry weight)	Methanol (1); Sodium Bisulfate (2); or Organic-Free Water; Cool 4°C	14 days

APPENDIX A

OHIO VOLUNTARY ACTION PROGRAM STANDARDS/VALUES

(c) Table II: generic direct-contact soil standards for carcinogenic and non-carcinogenic chemicals of concern - Commercial and Industrial Land Use Categories (values are in mg/kg).

Chemical Abstract Service Number (CAS #)	Chemical of Concern	Standard for Single Chemical Noncarcinogen	Standard for Single Chemical Carcinogen	Soil Saturation	Generic Direct Contact Soil Standard for a Single Chemical (mg/kg)
Volatile Organic Chemicals					
67-64-1	Acetone	850,000	NA	100,000	100,000
71-43-2	Benzene	170	140	920	140
75-15-0	Carbon Disulfide	2,200	NA	1,400	1,400
56-23-5	Carbon Tetrachloride	8.2	15	1,400	8.2
108-90-7	Chlorobenzene	710	NA	740	710
75-00-3	Chloroethane	18,000	68,000	2,200	2,200
67-66-3	Chloroform	600	14	3,400	14
124-48-1	Dibromochloromethane	59,000	2,300	1,600	1,600
75-71-8	Dichlorodifluoromethane	520	NA	1,400	520
75-34-3	Dichloroethane, 1,1-	3,000	NA	2,300	2,300
107-06-2	Dichloroethane, 1,2-	17,000	19	2,900	19
75-35-4	Dichloroethene, 1,1-	610	NA	1,700	610
156-59-2	Dichloroethene, *cis*-1,2-	29,000	NA	2,200	2,200
156-60-5	Dichloroethene, *trans*-1,2-	260	NA	1,800	260
78-87-5	Dichloropropane, 1,2 -	31	41	1,100	31
542-75-6	Dichloropropene, 1,3 -	130	84	810	84
123-91-1	Dioxane, 1,4-	160,000	600	270,000	600
60-29-7	Ethyl Ether	590,000	NA	33,000	33,000
100-41-4	Ethylbenzene	8,500	NA	230	230
50-00-0	Formaldehyde	2,900	1,200	130,000	1,200
64-18-6	Formic acid	1,700	NA	170,000	1,700
110-54-3	Hexane, *n*-	800	NA	190	190
78-83-1	Isobutyl Alcohol	880,000	NA	40,000	40,000
67-56-1	Methanol	240,000	NA	110,000	110,000
78-93-3	Methyl Ethyl Ketone (MEK)	220,000	NA	100,000	100,000
108-10-1	Methyl Isobutyl Ketone (MIBK)	97,000	NA	16,000	16,000
1634-04-4	Methyl *tert*-Butyl Ether (MTBE)	28,000	1,900	6,700	1,900
75-09-2	Methylene Chloride	4,900	570	2,300	570
100-42-5	Styrene	29,000	NA	1,700	1,700
630-20-6	Tetrachloroethane , 1,1,1,2-	88,000	81	750	81
79-34-5	Tetrachloroethane, 1,1,2,2-	180,000	24	1,700	24
127-18-4	Tetrachloroethene	1,700	53	380	53
108-88-3	Toluene	33,000	NA	520	520
71-55-6	Trichloroethane, 1,1,1-	11,000	NA	1,300	1,300
79-00-5	Trichloroethane, 1,1,2-	12,000	55	2,600	55
79-01-6	Trichloroethene	3,200	150	950	150
75-69-4	Trichlorofluoromethane	1,600	NA	1,600	1,600
96-18-4	Trichloropropane, 1,2,3-	18,000	28	1,100	28

Chemical Abstract Service Number (CAS #)	Chemical of Concern	Standard for Single Chemical Noncarcinogen	Standard for Single Chemical Carcinogen	Soil Saturation	Generic Direct Contact Soil Standard for a Single Chemical (mg/kg)
75-01-4	Vinyl Chloride	210	12	1,100	12
1330-20-7	Xylenes, Total	1,500	NA	370	370
Semi-Volatile Organic Chemicals					
83-32-9	Acenaphthene	56,000	NA	NA	56,000
98-86-2	Acetophenone	110,000	NA	NA	110,000
107-13-1	Acrylonitrile	48	16	22,000	16
62-53-3	Aniline	540	7,400	62,000	540
120-12-7	Anthracene	280,000	NA	NA	280,000
92-87-5	Benzidine	3,400	0..30	NA	0..30
56-55-3	Benzo(a)anthracene	NA	76	NA	76
50-32-8	Benzo(a)pyrene	NA	7.7	NA	7.7
205-99-2	Benzo(b)fluoranthene	NA	77	NA	77
207-08-9	Benzo(k)fluoranthene	NA	770	NA	770
117-81-7	Bis (2-ethylhexyl) Phthalate (BEHP & DEHP)	22,000	4,800	190	190
85-68-7	Butyl Benzyl Phthalate	220,000	4,800	58	58
86-74-8	Carbazole	NA	3,400	NA	3,400
57-74-9	Chlordane	670	270	NA	270
218-01-9	Chrysene	NA	7,600	NA	7,600
53-70-3	Dibenz(a,h)anthracene	NA	7.7	NA	7.7
95-50-1	Dichlorobenzene, 1,2- (o)	4,600	NA	370	370
106-46-7	Dichlorobenzene, 1,4- (p)	17,000	130	NA	130
91-94-1	Dichlorobenzidine, 3,3-	NA	110	NA	110
72-54-8	Dichlorodiphenyldichloroethane (DDD)	4,100	470	NA	470
72-55-9	Dichlorodiphenyldichloroethene (DDE)	NA	310	NA	310
50-29-3	Dichlorodiphenyltrichloroethane (DDT)	1,000	350	NA	350
94-75-7	Dichlorophenoxyacetic acid, 2,4-	11,000	NA	NA	11,000
84-66-2	Diethyl Phthalate	900,000	NA	590	590
105-67-9	Dimethylphenol, 2,4-	22,000	NA	NA	22,000
84-74-2	Di-*n*-butyl Phthalate	110,000	NA	110	110
99-65-0	Dinitrobenzene, 1,3- (m)	110	NA	NA	110
528-29-0	Dinitrobenzene, 1,2-	110	NA	NA	110
121-14-2	Dinitrotoluene, 2,4-	2,200	98	NA	98
606-20-2	Dinitrotoluene, 2,6-	1,100	100	NA	100
72-20-8	Endrin	340	NA	NA	340
107-21-1	Ethylene Glycol	760,000	NA	110,000	110,000
206-44-0	Fluoranthene	37,000	NA	NA	37,000
86-73-7	Fluorene	37,000	NA	NA	37,000
76-44-8	Heptachlor	560	8.9	NA	8.9
1024-57-3	Heptachlor Epoxide	15	7.0	NA	7.0
87-68-3	Hexachloro-1,3-Butadiene	220	240	1,000	220
118-74-1	Hexachlorobenzene	900	28	NA	28

Chemical Abstract Service Number (CAS #)	Chemical of Concern	Standard for Single Chemical Noncarcinogen	Standard for Single Chemical Carcinogen	Soil Saturation	Generic Direct Contact Soil Standard for a Single Chemical (mg/kg)
67-72-1	Hexachloroethane	1,100	1,700	NA	1,100
193-39-5	Indeno(1,2,3-c,d)pyrene	NA	77	NA	77
78-59-1	Isophorone	140,000	71,000	4,600	4,600
98-82-8	Isopropylbenzene (Cumene)	5,700	NA	260	260
58-89-9	Lindane	550	70	NA	70
108-39-4	m-cresol	56,000	NA	61,000	56,000
72-43-5	Methoxychlor	5,600	NA	NA	5,600
90-12-0	Methylnaphthalene, 1-	66,000	NA	360	360
91-20-3	Naphthalene	280	150	NA	150
98-95-3	Nitrobenzene	170	NA	1,500	170
86-30-6	Nitrosodiphenylamine, *n*-	22,000	10,000	NA	10,000
95-48-7	o-cresol	56,000	NA	NA	56,000
117-84-0	Octyl Phthalate, di-*n*-	45,000	NA	12	12
106-44-5	p-cresol	5,600	NA	NA	5,600
87-86-5	Pentachlorophenol	17,000	280	NA	280
108-95-2	Phenol	66,000	NA	NA	66,000
1336-36-3	Polychlorinated Biphenyls	18	26	NA	18
129-00-0	Pyrene	28,000	NA	NA	28,000
110-86-1	Pyridine	1,100	NA	400,000	1,100
93-72-1	Silvex	9,000	NA	NA	9,000
8001-35-2	Toxaphene	NA	59	NA	59
95-95-4	Trichlorophenol, 2,4,5-	110,000	NA	NA	110,000
88-06-2	Trichlorophenol, 2,4,6-	NA	4,400	NA	4,400
95-63-6	Trimethylbenzene, 1,2,4-	120	NA	250	120
108-67-8	Trimethylbenzene, 1,3,5-	95	NA	200	95
99-35-4	Trinitrobenzene, 1,3,5- (s)	34,000	NA	NA	34,000
108-05-4	Vinyl Acetate	2,000	NA	2,700	2,000
Inorganic Chemicals					
7440-36-0	Antimony	1,200	NA	NA	1,200
7440-38-2	Arsenic, Inorganic	610	82	NA	82
7440-39-3	Barium and Compounds	370,000	NA	NA	370,000
7440-41-7	Beryllium and Compounds	5,100	39,000	NA	5,100
7440-43-9	Cadmium	2,300	52,000	NA	2,300
16065-83-1	Chromium (III)	1,000,000	NA	NA	1,000,000
18540-29-9	Chromium (VI)	8,400	7,900	NA	7,900
7440-48-4	Cobalt	23,000	34,000	NA	23,000
57-12-5	Cyanide, Free	59,000	NA	NA	59,000
7782-41-4	Fluorine (soluble fluoride)	180,000	NA	NA	180,000
7439-97-6	Mercury	290	NA	NA	290
7440-02-0	Nickel (Soluble Salts)	44,000	NA	NA	44,000
7782-49-2	Selenium and Compounds	15,000	NA	NA	15,000
7440-22-4	Silver	15,000	NA	NA	15,000
7440-28-0	Thallium	230	NA	NA	230
7440-62-2	Vanadium	26,000	NA	NA	26,000
7440-66-6	Zinc and Compounds	880,000	NA	NA	880,000

Section 4.0 Ohio EPA Derived Leach-Based Soil Values

The following tables provide generic leach-based soil values for organics (Table I) and metals (Table II). These values are applicable under the conditions specified in Section 3.0.

Table I: Generic Leach-Based Soil Values for Organic Chemicals

Chemical (Organics)	Soil Type I* (mg/kg)	Soil Type II* (mg/kg)	Soil Type III* (mg/kg)
Benzene	0.017	0.0090	0.015
Toluene	6.8	4.1	7.7
Ethylbenzene	12	7.9	16
Total Xylenes	156	96	191
Styrene	0.46	0.37	0.62
Naphthalene	0.27	0.28	0.36
***n*-Hexane**	121	111	104
Methyl Ethyl Ketone	1.8	1.8	1.8
Phenol	1.1	1.1	1.2
Carbon Tetrachloride	0.25	0.25	0.28
1,2-Dichloroethane	0.0030	0.0020	0.0030
1,1,1-Trichloroethane	1.2	0.74	1.3
Vinyl Chloride	0.0090	0.0050	0.012
1,1-Dichloroethene	0.28	0.10	0.24
***cis*-1,2-Dichloroethene**	0.12	0.070	0.12
***trans*-1,2-Dichloroethene**	0.41	0.23	0.40
Trichloroethene	0.036	0.023	0.048
Tetrachloroethene	0.15	0.11	0.27

* The leach-based soil values contained in Table I assume a dilution factor of 1.0.

Table II: Generic Leach-Based Soil Values for Inorganic Chemicals

Chemical (inorganic)	**Leach-based Value** for sources ≥ ½ acre (mg/kg)	**Leach-based Value** for sources< ½ acre (mg/kg)
Antimony	3.6	7.2
Arsenic	3	6
Barium	56,000	110,000
Beryllium	57	114
Cadmium	21	42
Chromium	56	113
Lead	89	178
Mercury	12	23
Nickel	182	363
Selenium	2.15	4.3
Silver	3120	6240
Thallium	1.5	3.0
Vanadium	130	65
Zinc	44,000	88,000

*Values calculated based on the assumption that chromium is all chromium (VI)

**The leach-based soil values contained in the Table II assume a dilution-attenuation factor of 10.0 for source areas ½ acre or greater and a dilution-attenuation factor of 20.0 for source areas less than ½ acre.

Section 5.0 Ohio EPA Derived Dilution Factors

The leach-based soil values for the organic chemicals that are contained in Table I assume a dilution factor of 1.0. If appropriate, a volunteer or certified professional may apply one of the dilution factors contained in Tables III through V of this document to account for the effect of mixing between water leaching though the vertical zone of contamination and ground water migrating laterally through the aquifer. **The dilution factors contained in Tables III through V may only applied to the leach-based values contained in Table I (organic chemicals).** The leach-based values contained in Table II already assume a dilution-attenuation factor (DAF of 10.0 or 20.0, depending on the size of the source area).

The dilution factors contained in Tables III through V are appropriate to use for properties where the following conditions exist:

- The leach-based soils on the property can be classified into one of the three soil type categories (i.e. soil types I, II or III which are described in the Section 2.0 of this document).
- The ground water upgradient of the property has not been impacted by a release of hazardous substances or petroleum (i.e. the concentrations of hazardous substances or petroleum in the ground water are at background levels or not detectable).